WHAT IS CLAIMED IS:

1. A method for optimizing the deposition of siloxanes and fluorinated aromatic polymers by controlling at least one of the power level of a reactor, the gas flow rates to the reactor, the vacuum pressure inside the reactor and the mixture of siloxanes and fluorinated aromatic polymers.

2. The method of claim 1, wherein the concentration of siloxanes decreases and the concentration of aromatic hydrocarbons increases as deposition on a substrate occurs in order to provide an adhesive layer on the substrate overlaid by a layer of material with low dielectric constant.

3. The method of claim 1, wherein the mixture of siloxanes and aromatic hydrocarbons is varied to provide an adhesive layer on a substrate overlaid by a layer of material with low dielectric constant.

4. The method of claim 1, wherein the reactor is one of a plasma enhanced, high density plasma enhanced and a photon assisted process of transport polymerization or chemical vapor deposition.

5. The method of claim 1, wherein the power levels range from about 1 W/cm^2 to about 20 W/cm^2, and preferably from about 12 W/cm^2 to about 20 W/cm^2

6. The method of claim 5, wherein the power levels for an 8 inch diameter wafer ranges from about 500 Watts to about 4000 Watts.

7. The method of claim 1, wherein the gas flow rates range from about 30 SCCM to about 90 SCCM and preferably from about 50 SCCM to about 75 SCCM.

8. The method of claim 1, wherein the reaction is carried out with a vacuum pressure range of about 1 mTorr to about 100 milliTorr, and preferably from about 2 to 10 milliTorr.

9. The method of claim 1 for making void-free thin films with dielectric constants ranging from about 2.0 to 2.6 can be obtained with deposition rates ranging from about 100Å/min to about 4000Å/min.

10. The method of claim 1 for making films having glass transition temperatures ranging from about 150° C to about 400° C, preferably about 300° C.

11. The method of claim 1 for making films having residual stress of from about -50 MPas on the compressive side to about 50 MPa on the tensile side, preferably about -10 MPa on the compressive side.

12. A method for optimizing the deposition of siloxanes and fluorinated aromatic polymers by controlling the mixture of siloxanes and fluorinated aromatic polymers.

13. The method of claim 12 wherein the siloxanes provide both adhesion and barrier functions, and wherein the fluorinated aromatics provide barrier and low dielectric functions.

14. The method of claim 12, wherein the mixture of siloxanes and aromatic hydrocarbons is varied to provide an adhesive layer on a substrate overlaid by a layer of material with low dielectric constant.

15. A method for depositing void-free thin film dielectrics with dielectric constants ranging from about 2.0 to about 2.6.

16. A method for depositing void-free thin film dielectrics, wherein the deposition rates range from about 100Å/min to about 4000Å/min.

17. A method for depositing thin film dielectrics on metal, wherein a first deposit is of a siloxane dielectric having a thickness of about 100Å to about 500Å, and a second deposit is of a fluorinated aromatic dielectric.

18. The method of claim 17, wherein the mixture of siloxanes and aromatic hydrocarbons is varied to provide an adhesive layer on a substrate overlaid by a layer of material with low dielectric constant.

19. A method of depositing a thin film dielectric by depositing copolymers of siloxanes and fluorinated aromatic compounds by introducing admixtures with varying ratios of siloxanes and fluorinated aromatic precursors.

20. A method for depositing a hydrophobic thin film dielectric, comprising depositing a thin film of a siloxane and a fluorinated aromatic polymer by controlling the mixture of siloxanes and fluorinated aromatic precursors.

21. The method of claim 20 for depositing a thin film dielectric for hermetically sealing an (copper) integrated circuit employing interconnect comprised of polysilicon, aluminum, copper, mixtures of such materials including incorporation of refractory materials selected from the group consisting of W, Ta, Ti, Pt, and Ag.

22. A semiconductor thin film made from a precursor, said precursor having the structure:

$$\left(\text{-0 - }\underset{\displaystyle R''}{\overset{\displaystyle R'}{\underset{|}{\overset{|}{Si}}}}\text{-}\right)_n$$

wherein R' and R'' are selected independently from the group consisting of fluorinated alkyl groups; aromatic mono-, di-, tri-or tetra-radicals, and fluorinated derivatives of aromatic mono-, di-, tri-or tetra-radicals, and wherein n is an integer of from about 2 to about 7, preferably from about 4 to about 5, and wherein said precursor is processed in at least one of a transport polymerization process and a chemical vapor deposition process.

23. A semiconductor thin film comprising molecular structures of siloxane and aromatic moieties, with high rotational flexibility between said siloxane moieties and said aromatic moieties to permit tight bonding of the molecule to the substrate.

24. The semiconductor thin film of claim 23, wherein the aromatic moieties are fluorinated.

25. The semiconductor thin film of claim 23, wherein the thin film is made from a precursor, said precursor having the structure:

$$\left(-0-\underset{\displaystyle R''}{\overset{\displaystyle R'}{\underset{|}{\overset{|}{Si}}}}-\right)_n$$

wherein R' and R'' are selected independently from the group consisting of fluorinated alkyl groups; aromatic mono-, di-, tri-or tetra-radicals, and fluorinated derivatives of aromatic mono-, di-, tri-or tetra-radicals, and wherein n is an integer of from about 2 to about 7, preferably from about 4 to about 5, and wherein said precursor is processed in at least one of a transport polymerization process and a chemical vapor deposition process.

26. The film of claim 22 used as a barrier layer.

27. The film of claim 22 used as a barrier layer over a metalization layer.

28. The film of claim 22 used as an adhesion layer.

29. The thin film of claim 22, wherein the R' and R'' groups of said precursor are selected independently from the group consisting of -H, $-CH_3$, $-CF_3$, $-(CH_2)_n-CF_3$,

$-C_2H_5$,

$-C_6H_5$,

$-C_6(CF_3)H_4$,

$-C_6F_nH_{(6-n)}$, wherein n is an integer of from 0 to 6,

$-CF_3-C_6F_5$,

$-CF_3-C_6F_4-CF_3$,

$-CF_3-C_6F_4-C_6F_5$,

$-CF_3-C_6F_4-C_6F_4-CF_3$,

$-C_{10}F_8$,

$-CF_2-C_6H_4-CF_2$,

$-C_{10}H_{(6-n)}F_n-$, wherein n is an integer ranging from 0 to 6,

$-C_{12}H_{(8-n)}F_n-$, wherein n is an integer ranging from 0 to 8,

$-C_{13}H_{(7-n)}F_n-$, wherein n is an integer ranging from 0 to 7,

$-C_{14}H_{(8-n)}F_n-$, wherein n is an integer ranging from 0 to 8,

$-C_{16}H_{(10-n)}F_n-$, wherein n is an integer ranging from 0 to 10,

$-C_{10}H_{(8-n)}F_n-$ wherein n is an integer of from 0 to 8,

$-C_{16}H_{(8-n)}F_n-$, wherein n is an integer of from 0 to 8,

$-C_{16}H_{(10-n)}F_n-$, wherein n is an integer from 0 to 10,

$-(C_6H_{4-n}F_n)-(C_{10}H_{6-m}F_m)-$, where n is an integer of from 1 to 4 and m is an integer of from 1 to 6, and

$-(C_{14}H_{(8-n)}F_n)-(C_{16}H_{(8-n)}F_n)-$, wherein n and m are independently integers of from 1 to 8.

30. A semiconductor thin film made from a precursor with the formula: $Y - Ar - (Y')_z$, wherein Y and Y' are leaving groups, z is an integer ranging from 1 to about 6, and Ar is an aromatic compound having at least one of a sp^2C-sp^2C double bond, a sp^2C-H bond and a sp^2C-F bond, and the film is used as one of a barrier layer and an adhesion layer.

31. The semiconductor thin film of claim 30, wherein Y and Y' are independently selected from the group consisting of -H, -Cl, -Br, -NR, -SR, $-SiR_3$, $-NR_2$ and $-SO_2R$, wherein R is selected independently from the group consisting of -H, an alky group and an aromatic mono-radical, and Ar is an isomer selected from the group consisting of

$-C_6F_nH_{(6-n)}$, wherein n is an integer of from 0 to 6,

$-CF_3-C_6F_5$,

$-CF_3-C_6F_4-CF_3$,

$-CF_3-C_6F_4-C_6F_5$,

$-CF_3-C_6F_4-C_6F_4-CF_3$,

$-C_{10}F_8$,

$-CF_2-C_6H_4-CF_2$,

$-C_{10}H_{(6-n)}F_n-$, wherein n is an integer ranging from 0 to 6,

$-C_{12}H_{(8-n)}F_n-$, wherein n is an integer ranging from 0 to 8,

$-C_{13}H_{(7-n)}F_n-$, wherein n is an integer ranging from 0 to 7,

$-C_{14}H_{(8-n)}F_n-$, wherein n is an integer ranging from 0 to 8,

$-C_{16}H_{(10-n)}F_n-$, wherein n is an integer ranging from 0 to 10,

$-C_{10}H_{(8-n)}F_n-$ wherein n is an integer of from 0 to 8,

$-C_{16}H_{(8-n)}F_n-$, wherein n is an integer of from 0 to 8,

$-C_{16}H_{(10-n)}F_n-$, wherein n is an integer from 0 to 10,

$-(C_6H_{4-n}F_n)-(C_{10}H_{6-m}F_m)-$, where n is an integer of from 1 to 4 and m is an integer of from 1 to 6, and

$-(C_{14}H_{(8-n)}F_n)-(C_{16}H_{(8-n)}F_n)-$, wherein n and m are independently integers of from 1 to 8.

32. The semiconductor thin film of claim 30, wherein Y is a leaving group selected from the group consisting of -H and -F.

33. The semiconductor thin film of claim 30, wherein the end-to-end length of the aromatic moiety is at least 4 Å.

34. The semiconductor thin film of claim 30, wherein the end-to-end length of the aromatic moiety is at least 6 Å.

35. The thin film of claim 22 or claim 30, wherein said precursor is processed using one of a transport polymerization process or a chemical vapor deposition process.

36. A thin film of claim 35, wherein the transport polymerization process is selected from at least one of the group consisting of plasma enhanced transport polymerization, high density plasma transport polymerization, photon assisted transport polymerization, plasma enhanced chemical vapor deposition, high density plasma chemical vapor deposition, and photon assisted chemical vapor deposition.

37. The thin film of claim 35, wherein the photon assisted process utilizes electromagnetic radiation of at least one of infrared, ultraviolet and vacuum ultraviolet wavelengths.

38. The thin film of claim 37, wherein the vacuum ultraviolet light is generated using incoherent excimer radiation.

39. The thin film of claim 36, wherein the plasma is generated using one of a radio frequency generator and a microwave generator.

40. The thin film of claim 39, wherein the plasma is generated using radio frequencies in the range of from about 1 kHz and about 2.5 GHz.

41. The thin film of claim 40, wherein the plasma is generated using radio frequencies in the range of from about 400 kHz to about 14 MHz.

42. The thin film of claim 40, wherein the plasma is generated using radio frequencies of about 13.56 MHz.

43. The thin film of claim 40, wherein the plasma source power is in the range of about 100 Watts to about 4000 Watts and the chamber pressure is in the range of about 0.01 milliTorr and about 10 milliTorr.

44. The thin film of claim 40, wherein the plasma source power is in the range of about 1 $Watt/cm^2$ to about 15 $Watt/cm^2$, and is preferably about 5 $Watt/cm^2$.

45. The thin film of claim 40, wherein the plasma is generated using a microwave generator.

46. The thin film of claim 45, wherein the microwave power is between about 200 Watts and about 700 Watts.

47. The thin film of claim 45, wherein the microwave power is between about 400 Watts and about 600 Watts.

48. The thin film of claim 45, wherein the microwave power is about 500 Watts.

49. A method of manufacturing a step-gradient thin film comprising:

(a) selecting a first precursor,

(b) selecting a second precursor,

(c) processing said first precursor in at least one of a transport polymerization and chemical vapor deposition system to dissociate said first precursor,

(d) depositing a thin film of polymer comprised of said dissociated first precursor,

(e) processing said second precursor in at least one of a transport polymerization and chemical vapor deposition system to dissociate said second precursor,

(f) depositing a thin film of polymer comprised of said dissociated second precursor.

50. The semiconductor thin film made by the process of claim 49.

51. A semiconductor thin film of claim 50, wherein said first layer comprises molecular structures of siloxane and aromatic moieties, with high rotational flexibility between said siloxane moieties and the aromatic moieties to permit tight bonding of the molecule to the substrate.

52. The semiconductor thin film of claim 50, having an adhesive layer comprising a siloxane, and a low dielectric constant layer comprising fluorinated aromatic moiety.

53. The semiconductor thin film of claim 50, wherein said first layer comprises essentially a siloxane, and wherein said second layer comprises essentially a hydrocarbon.

54. The semiconductor thin film of claim 50, wherein said first layer comprises a adhesion layer, and wherein said second layer comprises a barrier layer.

55. The semiconductor thin film of claim 50, including a metalized layer, wherein said first layer comprises a adhesion layer laid down on the metalized layer, and said second layer comprises a barrier layer laid down on the adhesion layer.

56. A method for manufacturing a continuous-gradient thin film comprising:

(a) selecting a first amount of a first precursor,

(b) selecting a first amount of a second precursor,

(c) mixing said first and second precursors,

(d) dissociating said mixture,

(e) depositing said dissociated said mixture,

(f) progressively changing the relative proportions of said first precursor and said second precursor in said mixture,

(g) processing said mixture in at least one of a transport polymerization and chemical vapor deposition system to dissociate said mixture of first and second precursors,

(h) depositing said mixture of dissociated precursors to form the gradient of semiconductor thin film.

57. A semiconductor thin film made by the process of claim 56.

58. A semiconductor thin film of claim 56, wherein said first layer comprises molecular structures of siloxane and an aromatic moiety, with high rotational flexibility between said siloxane and said aromatic moieties to permit tight bonding of the molecule to the substrate.

59. The method of claim 49 or 56, wherein the first precursor is a siloxane layer which provides adhesion and barrier layer functions and the second precursor is a fluorinated aromatic hydrocarbon layer which provides high thermal stability and low dielectric constant functions.

60. The method of claim 49 or 56, wherein the first precursor provides adhesion and barrier layer functions and the second precursor provides high thermal stability and low dielectric constant functions.

61. The semiconductor thin film of claim 49, wherein said first layer comprises essentially a siloxane, and wherein said second layer comprises essentially a hydrocarbon.

62. The semiconductor thin film of claim 49, wherein said first layer comprises a adhesion layer, and wherein said second layer has a glass transition temperature of greater than about 400° C, and a dielectric constant of between about 2.0 and about 2.6.

63. The semiconductor thin film of claim 49, including a metalized layer, wherein said first layer comprises a adhesion layer laid down on the metalized layer, and said second layer comprises a layer having a glass transition temperature of greater than about 400° C, and a dielectric constant of between about 2.0 and about 2.6. laid down on the adhesion layer.

64. The semiconductor thin films of claim 49 or claim 56, wherein the residual stress is between about 5 and about 30 MPa at room temperature.

65. A semiconductor thin film comprising a siloxane layer providing an adhesion and barrier layer functions and a fluorinated aromatic hydrocarbon layer providing high thermal stability and low dielectric functions.

66. A polymer thin film which inhibits the exposure of semiconductor devices to water.

67. A polymer thin film comprising which inhibits the diffusion of metal ions into said polymer thin film.